LASER OPERATING COST

When evaluating usage cost of a platesetter, we consider determining “laser operating cost per plate” more important than simply determining the cost to purchase a replacement laser. While it is obviously important to know the cost to buy a replacement laser for a platesetter, it is even more important to know what kind of productivity you are obtaining for those dollars.

Violet Laser Vs Thermal Operating Cost

Platesetters utilizing violet laser diodes have several advantages regarding operating cost. These advantages include lower prices for replacement lasers and compatibility with considerably more sensitive plate emulsions. Since silver-based and photopolymer-based plates are much more sensitive than thermal plates, violet platesetters expend far less laser energy during exposure than their thermal counterparts. Furthermore, when considering machines currently available on the used market, violet platesetters are usually somewhat faster than competitively priced thermal systems. More plates imaged per hour with less laser energy expended by a lower priced laser equates to considerably less operating cost with a violet platesetter compared to a thermal machine.

To illustrate, we have prepared the following calculations comparing the Agfa GalileoVS (violet silver) with the Creo (Kodak) Trendsetter 3244 with a 40 W thermal laser head and the Screen PT-R 8600 thermal platesetters.

The Trendsetter exposure time is based upon 15 plates per hour less the load/unload time of one minute historically used by Creo for the Trendsetter models. For the PT-R 8600 we have used two minutes per plate that we have determined as typical from actual metered data obtained from the machines we have bought and sold.

	Galileo VS	**Trendsetter 3244**	**PT-R 8600**
Exposure minutes per plate	2.6	3.0	2.0
milliwatts of power per diode	5 mW	1,000 mW	500 mW
Quantity of diodes	1	19	64
mW minutes of power per plate	13	57,0000	64,0000
If the Galileo VS equals one -- then the comparative power requirement is	1	4,380	4,923

From the result of these calculations, it appears that a GalileoVS imaging silver plates uses approximately 4,000 to 5,000 times (13 vs 57,000 or 64,000 mW minutes) less energy per plate than a Trendsetter 3244VF or the PT-R 8600. This seems impossible, but if you turn to page 6 of this paper, you will probably conclude that this is not only feasible, but probably conservative.

This is not to say that the laser operating costs for thermal are 4,000 to 5,000 times more than violet platesetters imaging a silver plate, but there is no question that thermal platesetters require far more laser energy than violet systems and have far higher laser operating costs. The difference between violet lasers imaging photopolymer plates compared with thermal is also considerable, though not as great as silver. Furthermore, there is no denying that the replacement cost of violet lasers is less expensive than thermal. A new Galileo laser, for example, costs about $18,000, while a new Trendsetter laser head is $32,500. The PT-R 8600 lasers diodes cost approximately $2,000 each, but there are 64 of these in the machine. Whether this additional cost can be justified depends on whether you require the features found with thermal plates that are not available with violet. We address the pros and cons of each technology in the following section.

Thermal Diode Array Laser Operating Cost

To calculate the laser operating cost of diode array platesetters, we start by applying the table of estimated laser life of these diodes (see page 17) to determine the approximate number of lasers that will require replacement over the first 10,000 hours of the machine’s life. We then multiply this by the price of each individual diode to determine the laser operating cost for this time period. For a 32 diode Screen PT-R, we estimate a total operating cost of approximately $58,500. Our methodology for arriving at this cost is on the following page.

	Failure Rate	Foot-notes	Failure of Original 32 Diodes	Failure of Replaced Diodes	Total Failed Diodes	Total Cost @ $1,500 per diode
0 - 2,500 hrs	3%	(A)	1	0	1	$1,500.
2,500 - 5,000 hrs	25%	(B)	7	0	7	$10,500.
5,000 - 7,500 hrs	65%	(C)	13	2	15	$22,500.
7,500 - 8,700 hrs	80%	(D)	5	3	8	$12,000.
8,700 - 10,000 hrs	100%	(E)	6	2	8	$12,000.
			32	7	39	$58,500.

Footnotes:

(A) Applying the laser life percentages to an array of 32 lasers we calculated that in the period 0-2,500 hours, 3% of the 32 lasers statistically will fail, i.e. one laser.

(B) Of the remaining 31 diodes, it is estimated that at 5,000 exposure hours there will be 24 surviving diodes (75%). This means that 7 diodes will fail in this time period, for a total of 8 failed diodes (25%).

(C) At 7,500 hours it is estimated that there will be just 11 surviving diodes (35%) or a loss of an additional 13 diodes. Plus there is a loss of 2 of the 8 previously replaced diodes.

(D) Next at 8,700 hours it is estimated there will be 6 surviving diodes (20%) or a loss of 5 additional diodes plus a loss of 3 of the previously replaced diodes.

(E) Finally, at 10,000 hours, we can assume that the remaining 6 diodes will have expired, plus 2 of the previously replaced diodes.

Based on the statistical odds for the life-span of these diodes, we calculate that 39 total diodes will have to be replaced over the first 10,000 hours of the machine. At $1,500 per diode, the total operating cost equates to $58,500. This equates to $5.85 per hour. If you figure the machine will image approximately 200,000 plates over this 10,000 hour period (based on 20 plates per hour of laser exposure time), this works out to a cost of approximately 29 cents per plate laser operating cost.

A strategy used by Screen service, for units on service contract, has been to replace all of the remaining diodes when they are near end of life. By so doing, they avoid the cost of numerous service calls to replace near end of life diodes. The logic being that the cost of the service calls to replace near end of life diodes exceeds the remaining value of those diodes. This logic can apply to users not favoring the cost of service contracts by simply balancing the value remaining in the surviving diodes against the cost of the service calls to replace each individually.

Analysis of Per Plate Cost of Creo Laser Head

As stated in the Laser Life section of this paper, in actual operating experience a 6,000 hour life is typical for a 40 W Creo head and 7,000 hours is typical for a 20 W head. Our cost analysis will focus on the 6,000 hour life of the 40 W head.

Creo/Kodak offers 3 different speed models of this head, and they charge different prices for each speed. We don't have the exact price of the various heads, but we estimate a price of $28,000 for the Slow head, $32,500 for the Fast, and $38,000 for the Very Fast. Based on a 6,000 hour life for these head, to arrive at the laser operating cost per plate, we first calculated the cost per hour for each head as follows:

Head	Replacement Cost	Cost per hour (head cost divided by 6,000 hours)
Slow	$28,000.	$4.67
Fast	$32,500.	$5.42
Very Fast	$38,000.	$6.33

We then divided the cost per hour by the number of plates per hour each machine can expose, arriving at an approximate cost per plate:

Head	Plates Per Hour	Cost Per Hour	Cost Per Plate
Slow	12	$4.67	$0.389
Fast	18	$5.42	$0.301
Very Fast	21	$6.33	$0.301

Comparing two similar Creo and Screen models (the F speed Trendsetter 3244 and PT-R 8000), the laser cost per plate is surprisingly close - around 30 cents. However, there is one additional consideration that we have not included in these calculations, which is the service cost to replace lasers on this equipment. With the Trendsetter, you would require only one service call approximately every 6,000 hours to replace the head. While the probable life of the PT-R diodes is in the range of 6,000 hours, statistical analysis plus our own experience indicates you can expect some diodes to require replacement well before this hour threshold, while some will last longer. A service call would be required each time a diode needs replaced, however, the total can be mitigated by the wholesale replacement of near end of life diodes as suggested in the previous diode array section.

For some buyers, it is much easier to swallow replacing one diode at a time for $1,500 plus the service call, than accepting the fact that at some point over the life of a Trendsetter, you will have to pay out $32,500 for a new laser head. For others, the simplicity of having to deal with just one laser as in the Trendsetter is appealing. Buyers considering both the Trendsetters and the PT-Rs will have to weigh the pros and cons of each design.

Analysis of Internal Drum Single Diode Laser Cost

When we estimate the laser cost for a user of internal drum technology, where a single diode is the norm, it requires a much different approach. The first conclusion that may arise is the reality that if the total plate production that may be needed over the life of the machine is less than the quantity reasonably expected from the laser (even at its most conservative life expectancy) it is safe to conclude that there will be no laser cost incurred over the original capital outlay for the platesetter.

Since the life of a laser is not easily defined, it is perhaps best to look at logical scenarios for a laser life. Since 6,000 hours is a conservative minimum and 10,000 hours is a sensible maximum we can estimate the production of image area over the life of a laser. As a starting point for making this calculation, we took the register readings of a Prosetter 74 recently placed into our inventory. This unit produced 13,126 square meters of image with a laser exposure time of 1,054 hours or 12.45 m^2 each laser hour. If we convert this metric to imperial measure it translates to 19,297 square inches per hour or 19,297,000 per thousand hours. The following calculation converts this production to total output for the chosen laser life expectancies.

Hours of Laser Life	Sq.inches of thru-put (000)	Quantity 4-up plates 28.5” x 24.2” (690 sq. in.)	Quantity 8-up plates 40.5” x 31.4” (1271 sq. in.)	Cost per plate @ $20K laser cost 4-up	8-up
6,000	115,782	167,800	91,000	.119	.220
7,000	135,079	195,800	106,200	.102	.188
8,000	154,376	223,700	121,400	.089	.165
9,000	173,673	251,700	136,500	.079	.147
10,000	192,970	279,700	151,700	.072	.132

Since speed varies with the dpi setting when using internal drum technology, we have further calculated that this Prosetter was set at 2400 dpi. Should actual dpi be higher or lower than 2400 dpi, the throughput will decrease or increase in proportion to the dpi actually being use.

If the estimated quantity of plates you will reasonably expect to produce over the life you assign to the system is less than those shown above, it is reasonable to assume that you will incur no expense for laser replacement over the life you assign to your system.

Laser Life/Cost of Thermal Processless Plates

The increased power requirements of the 275 – 325 mJ/cm2 rated processless plates places an entirely new dimension upon the user of these plates. Obviously, from the foregoing information, greater laser power requirements from any given laser diode has a direct effect upon the life of that diode as it relates to the per plate cost of diode consumption. This cost per plate is realized in the form of either - increased laser intensity, thus shortening the life of the diode, or decreasing the speed of the imaging device to gain more dwell time for exposing the less sensitive emulsion.

In the case of the Creo head, a combination of both increased intensity and decreased drum rotation may be required. Whichever occurs, the end result is increased cost. Fortunately, this increased cost is mitigated by reduced chemical and chemical processor maintenance cost. The caveat is that when manufacturers tout the economic advantages of processless plates, the reduced cost of chemicals and processor maintenance is used as the justification for the increased cost of the plate. It has been our experience that there is an inclination to overlook increased laser diode cost as an economic factor. Of course energy consumption of the processor is always included in the savings side of the cost equation but nary a mention of the increased energy consumption for longer per plate image time and laser power requirements.

The higher power settings are not, as a general rule, disclosed by the technician reconfiguring your Trendsetter for processless. You will find it out when your laser head requires replacement at 3,000 hours instead of the expected 6,000 hours. This basically doubles your laser cost which we calculate on page 28 to be approximately $.30 per plate. This can be a cause for concern when you realize that you signed a plate contract for an extended period of time.

If you are using a laser (coupled) diode array technology commonly found in Screen manufactured platesetters, there is no increase in power settings. The added exposure requirement is attained by slowing down the drum revolutions from perhaps 800 RPM to 400 RPM. This slower speed of course, cannot be hidden as possible with the laser power setting, but the slower speed doubles the laser exposure thus doubling the laser cost and in addition increasing the number of service calls to replace those diodes not to mention the loss of output which can equate to added labor cost. Obviously if you are covered by a service contract it can be rationalized that this added cost does not exist. You may be right, but generally speaking nothing is free.

A caveat to those using Agfa and Kodak processless plates is that the previous calculations may be inadequate to accurately convey laser operating costs when imaging these plates. While these plates eliminate the cost of a processor, and related chemistry, it seems that there is no question that laser operating cost will be higher.

Not only are we seeing shorter laser life as a result of higher power setting, but we are also seeing the need for lasers to be replaced at an "end of life" sooner than a laser exposing lower energy plates. This is a reality because the laser will not generate the power required to expose the less sensitive processless plates yet that same laser has the latent power to expose the more sensitive thermal plate requiring chemical processing.

Granted, there are savings to be had by using processless technology, but seldom do you see those savings calculations tempered with the cost of laser diodes and energy cost to operate at higher power or longer throughput times – and of course, the service cost of laser replacement!

Analysis of Presstek Laser Cost

The entire laser module for the 8-up model is composed of 16 individual laser arrays (12 arrays for 2-up model) each with 4 diodes for a total of 64 diodes. If just one of the four diodes fails, it affects the quality of the output of the array and should be replaced. The normal replacement cost is in the range of $2,500 plus the service call.

Conventional external drum laser engineering moves the laser beam or beams across the axis of the drum. In so doing the exposure time is limited to the axis dimension of the plate. With the Presstek engineering, the entire 64 diodes are fixed across the axis of the drum. As a result, laser exposure takes place across the entire drum width regardless if media is there to expose. Waste only exists when the user exposes less than the maximum size plate but that added laser costs exists whenever less than full size is exposed.

Another factor adding to the laser cost is the sensitivity of the Presstek plate. Because their plate uses the ablative method of creating the image on the plate to avoid the conventional chemical based processing the sensitivity of the plate is rated at 600 mJ per cm^2. This compares with 110 to 150 mJ for a normal conventional plate or 300 mJ for the Agfa and Kodak processless plates. The added laser power affects the life of the laser diode which obviously equates to added cost. Thus we conclude, from our analysis, that the Presstek laser has the highest operating cost.